



**Human Systems Integration
Directorate**

Human Systems Integration in Systems Engineering

Brief to Undersea Human Systems Integration Symposium

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NAVSEA 03
07 June 2006**

Effects of Human Systems Integration

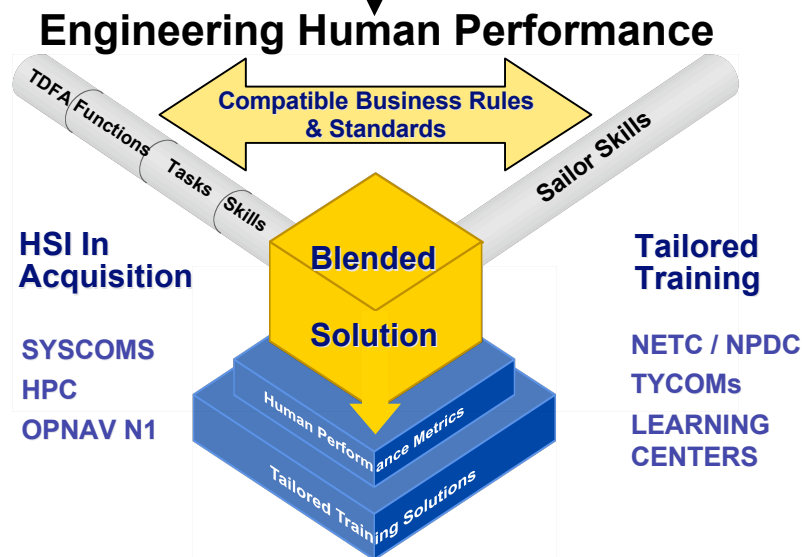


Fewer Personnel
More Complex
Operating Environment
Emerging Technology
Interoperability

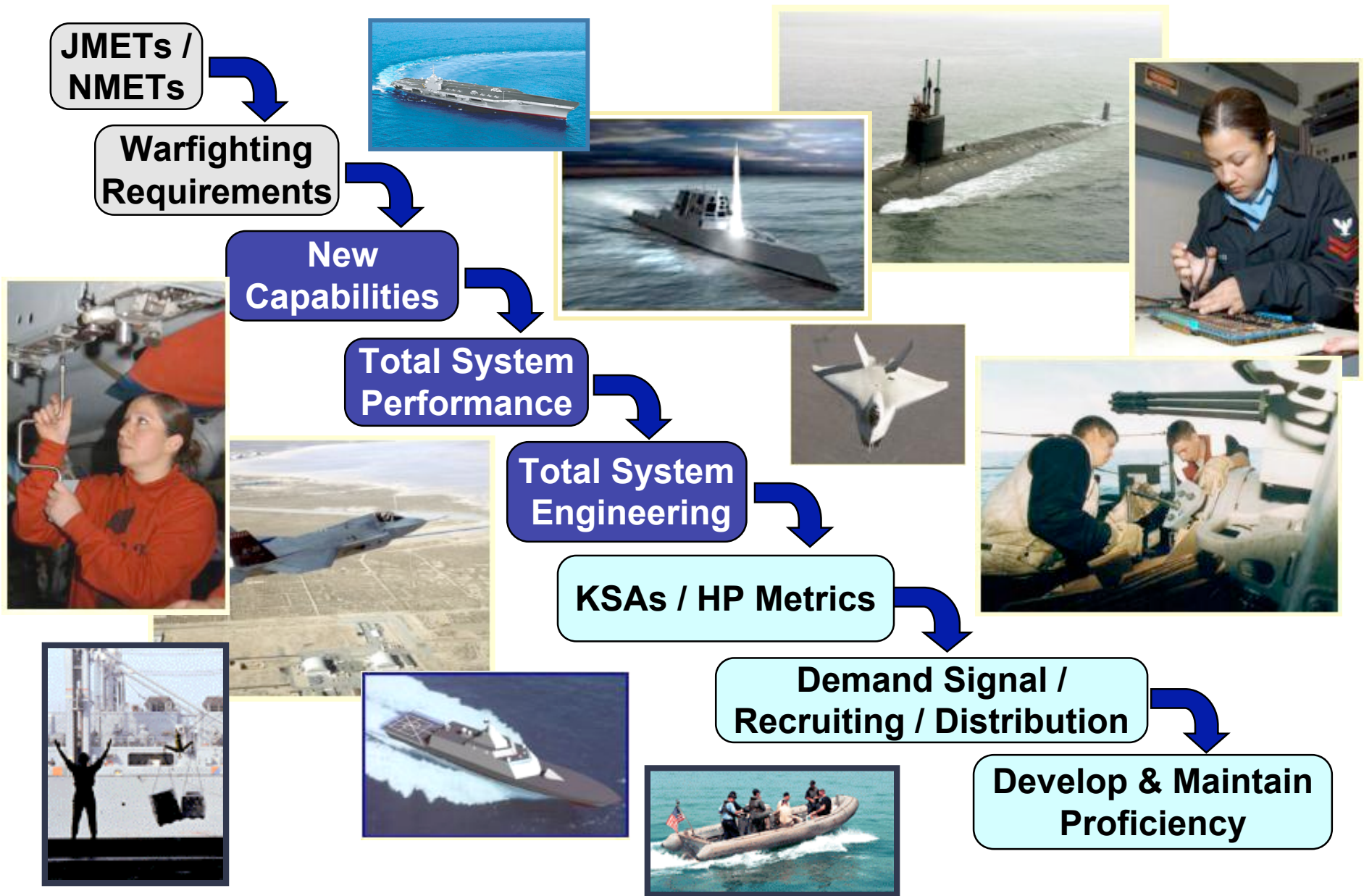


OUTPUTS

- Optimal mission readiness through skills analysis, tailored training and certified warfighter performance
- Integrated sea/shore based infrastructure
- Best Total Ownership Cost



From Requirements to Proficiency



Total Systems Engineering / Sea Warrior / HSI / Human Performance (HP) Relationship

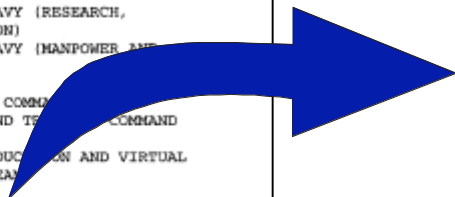



NAVSEA HSI Certification and Technical Authority

- HSI Certification Authority delegated by COMNAVSEA
 - SEA 03 is accountable for certifying that the systems delivered to the fleet:
 - Are usable
 - Enhance Sailor performance
 - Optimize manpower and training
 - Promote safety, survivability, and quality of service
- SEA 03 Charter includes:
 - Establish HSI Standards
 - Certify Programs
 - Provide Technical Assistance
 - Improve Sailor Performance
 - Coordination with Navy Initiatives

- HSI Technical Authority warranted by COMNAVSEA
- HSI Warrant includes all authority per NAVSEA Technical Authority Policy
 - Areas of responsibility include HFE, Manpower, Personnel, and Training
 - Technical assessment and certification of Programs
 - Sailor Performance
 - Optimal manning
 - Safety, survivability and QOL

CNO Directed Manpower, Personnel, Training and Education and Virtual Systems Command IPT



 **DEPARTMENT OF THE NAVY**
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
2000 NAVY PENTAGON
WASHINGTON, D.C. 20380-2000

NI
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DEV
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IN REPLY REFER TO

26 SEP 2005

MEMORANDUM FOR ASSISTANT SECRETARY OF THE NAVY (RESEARCH, DEVELOPMENT, AND ACQUISITION)
ASSISTANT SECRETARY OF THE NAVY (MANPOWER AND RESERVE AFFAIRS)
CHIEF OF NAVAL PERSONNEL
COMMANDER, NAVAL SEA SYSTEMS COMMAND
COMMANDER, NAVAL EDUCATION AND TRAINING COMMAND

Subj: MANPOWER, PERSONNEL, TRAINING, AND EDUCATION AND VIRTUAL SYSTEMS COMMAND INTEGRATED PROCESS TEAM

1. Sea Warrior is my commitment to the professional growth and personal development of our Sailors for the 21st century. Sea Warrior is a single integrated system, the lynch pin in concept and in execution, providing the description of a job, an individual, and bridging the difference between the two. Integral to the Navy's Human Capital Strategy, Sea Warrior will enhance warfighting performance by ensuring that we identify the right person, at the right place, with the right skill, at the right time, attaining the best value. Building on the Human Systems Integration principles (human factors engineering, personnel, habitability, manpower, training, environment, safety and occupational health, and survivability), the Human Systems Integration Functional Group of the Virtual Systems Command teamed with the Sea Warrior Enterprise Task Force to successfully integrate the Sea Warrior and SEAPRINT concepts within the systems engineering process. The DD(X) and LCS Flight 1 acquisition programs were the first two ACAT 1 programs to use the integrated Human Systems Integration process. This process produced manpower reductions and well defined knowledge, skills, and abilities that are based on operationally focused mission essential tasks that are measurable by human performance standards that maximize operational capability.

2. The Revolution in Training shifted training priorities from system-centric training solutions to a Sailor-centric human performance approach. Solutions now focus on precise skills and competencies (skill objects) required of a Sailor to perform in complex operational environments on optimally manned platforms and systems. Successful integration of Human Systems Integration in acquisition demands a top down, total systems, functional analysis process that determines specific functions

2

3

- CNO memo of 26 Sept 2005 established Integrated Process Team (IPT) to recommend Sea Warrior (SW) and Integrated Learning Environment (ILE) standards, processes, and specifications for use by acquisition programs.
- CNO advocated:
 - Using HSI in Total Systems Engineering process
 - Leveraging Human Performance (HP) systems model to develop SW & ILE capabilities to enhance warfighting performance and reduce Total Ownership Cost (TOC).
- Solution is addressed at several levels:
 - Requirements & Capabilities
 - Leadership
 - Acquisition

Recommendations from CNO Directed IPT

- **Requirements and Capabilities**

- OPNAV (N1) update and promulgate HSI/HP requirements analysis guidance for ICDs, CDDs, and CPDs
 - Approve vSYSCOM HSI/HP Requirements Templates
- OPNAV (N1) in coordination with FFC:
 - Promulgate HCO guidance for use in requirements generation & acquisition
 - Develop governance policy for HCO database
- OPNAV scope & resource programs to optimize TOC opportunities reduction & HP standards

- **Leadership**

- OPNAV (N1) establish Flag / SES advocate and sponsor for HP, SW, & ILE to coordinate with capability sponsors
- OPNAV (N1) promulgate SW (HSI/HP/ILE) Policy & Standards that improve sailor performance

- **Acquisition**

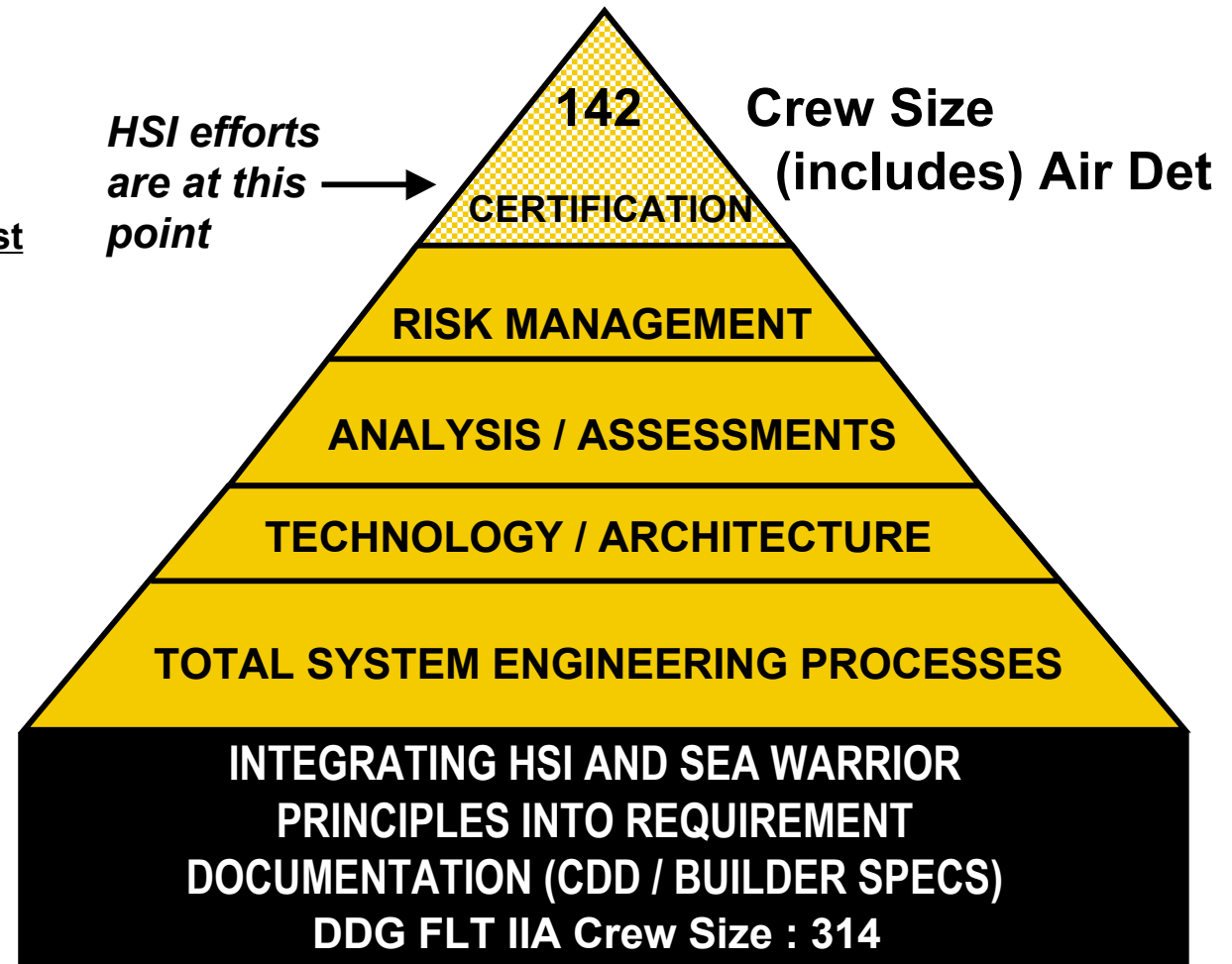
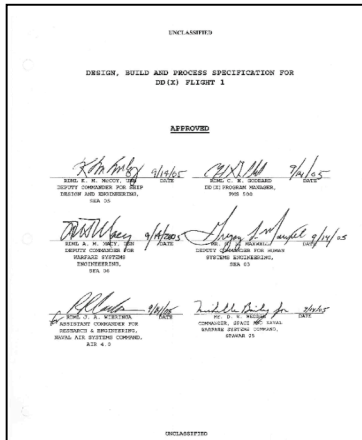
- OPNAV (N1) provide recommended language to ASN (RD&A) for approval / insertion in next SECNAVINST 5000.2C Revision
- ASN (RD&A) ensure PM's employ a TSE approach to identify HSI/HP requirements and deliver skills-based MPT&E products, as appropriate, to address such requirements
- ASN (RD&A) require HSI/HP impact be assessed in FNC projects

DDG 1000: HSI Progress

Manning KPP: Objective 125 – Threshold 175

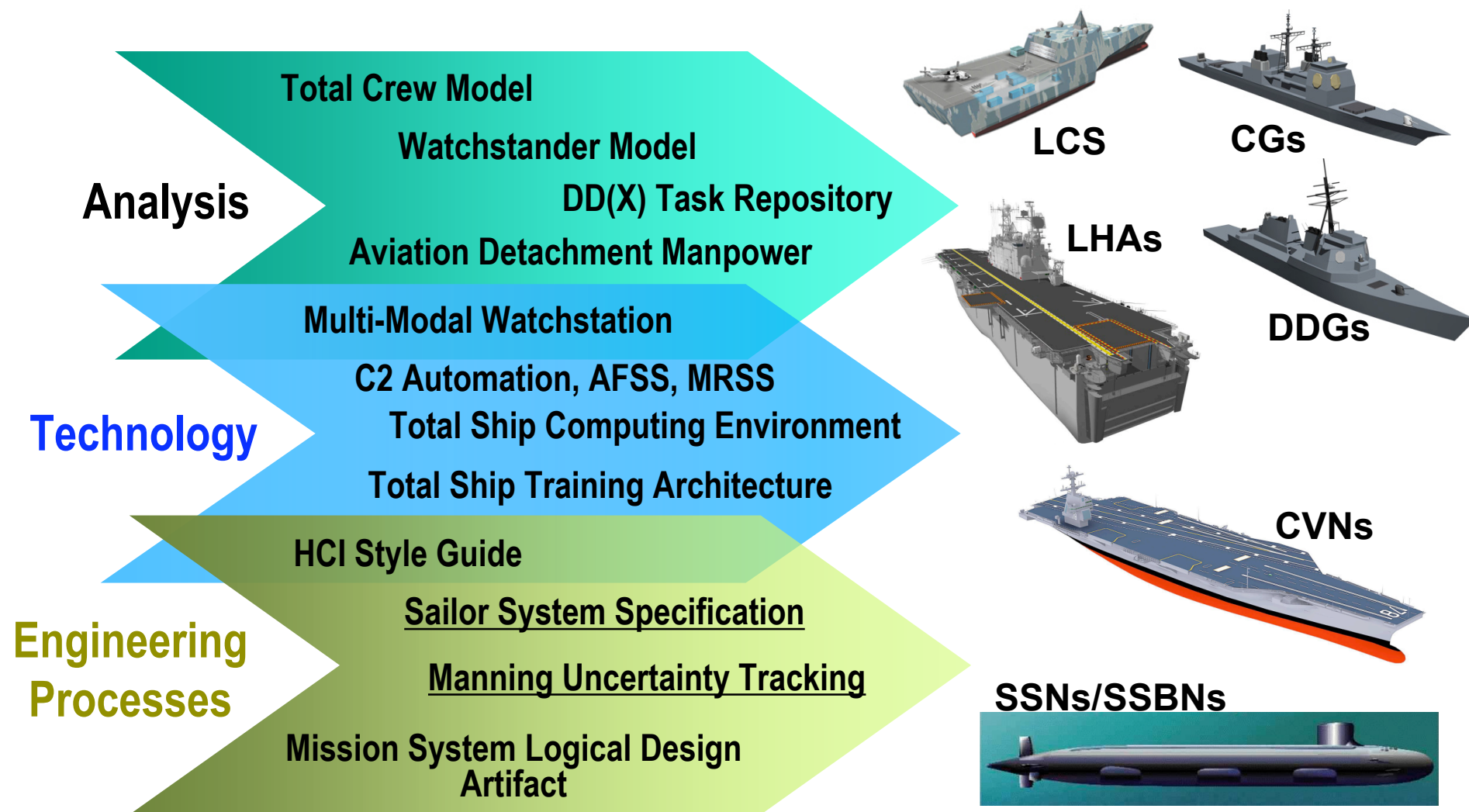
• DDG 1000 HSI Highlights:

- Sailor System Specification
- Total Crew Model
- Manning Uncertainties Issues List
- Total Ship Training Architecture Solution
- Critical Design Review approved



All Workload and Watchstation Requirements Are Being Met – Provides High Confidence for Achieving the Manning KPP

DDG 1000 HSI Leverage for Other Ship Programs



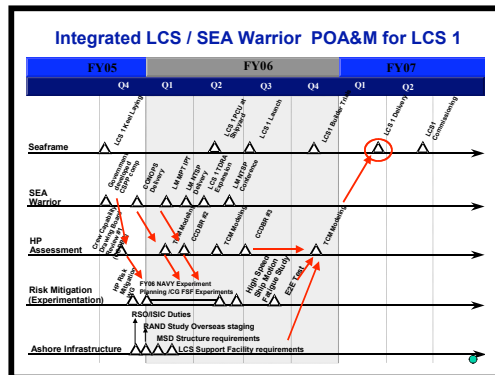
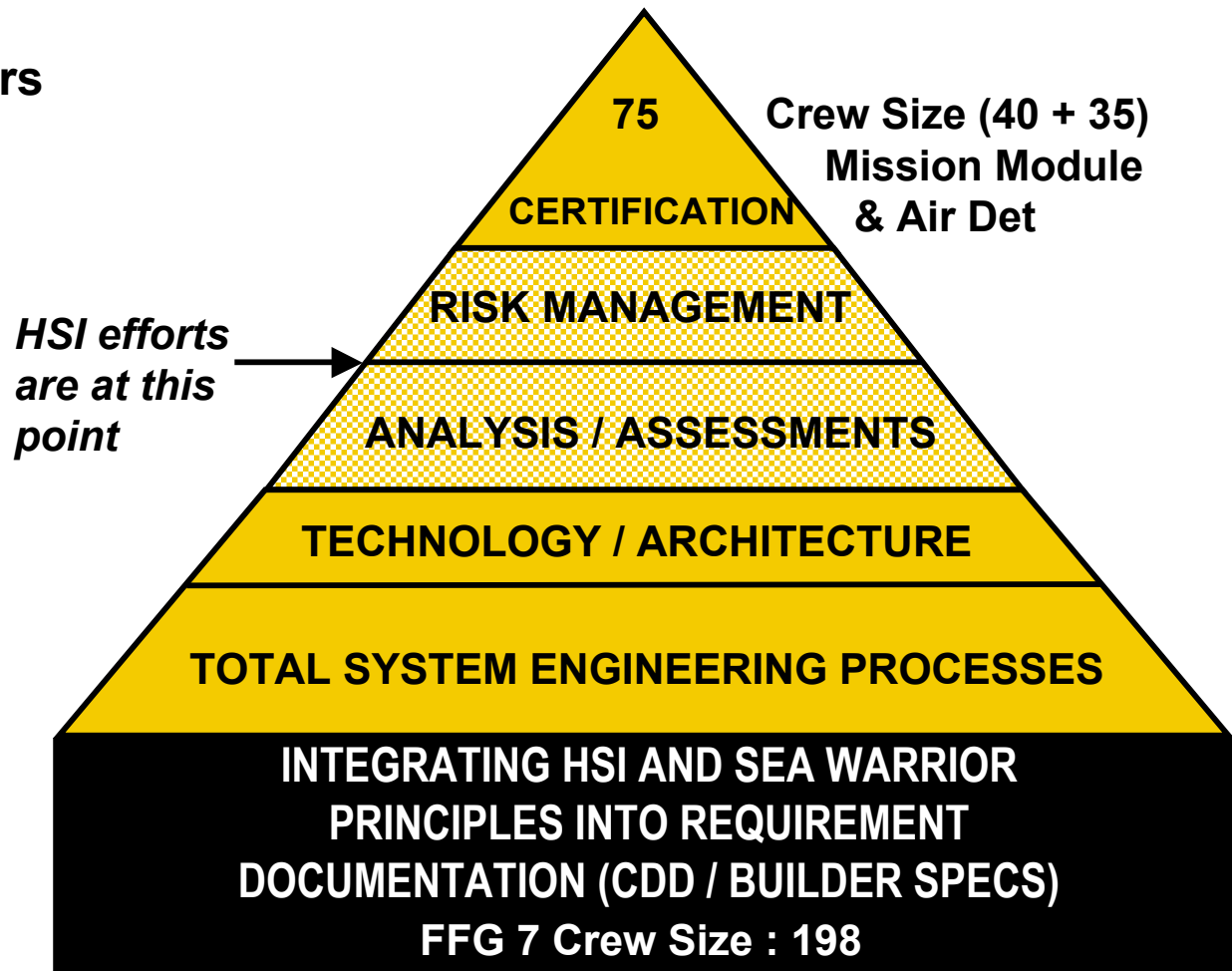
DDG 1000 HSI analysis, technology, and engineering processes are supporting existing and future Navy ship programs.

LCS: HSI Progress

• LCS HSI Highlights:

- Cross Functional Sailors
- Total Crew Model
- Train to Qualify
- Integrated POA&M

Sea Frame Manning KPP: Objective 40 – Threshold 40



Total System = Sea Frame + Mission Packages + Aviation + Shore Infrastructure

LCS 1: Train to Qualify (T2Q) Way Ahead

- Identify Shore Training Facility Resources
- Obtain Command /Control Processor for NCTE Interoperability
- Complete Development of T2Q MOEs/MOPs
- Define Individual / Team Trainer requirements/process
- Develop Trainer Scenarios
- Develop Navy Training System Plans
- Transition Vendor Training



“Sailors Must Board the Ship Ready To Do Their Jobs – All of Their Jobs”

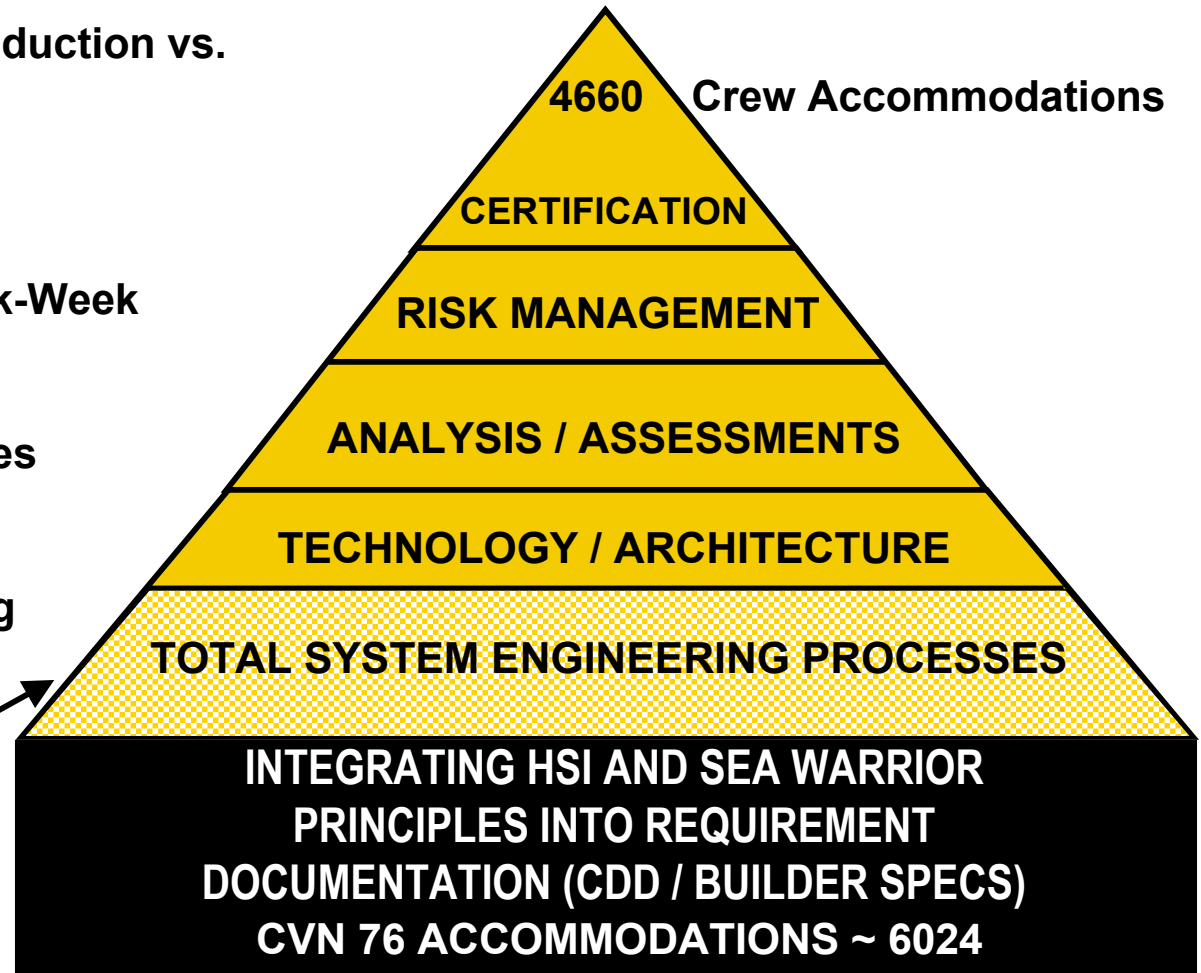
CVN 78: HSI Progress

Ship's Company Manning KPP:
Objective 2391 – Threshold 2791

CVN 78 HSI Challenges:

- Competing KPPs : Manpower Reduction vs. Sortie Generation Rate
- Skills Analysis Maturity
- Competing Priorities within Work-Week Distribution
- Integrating SEA Warrior principles into the program
- Implementing Total Ship Training System Requirements

*HSI efforts
are at this
point*



SEA Warrior / CVN 78 ESC ADDRESSING THESE CHALLENGES

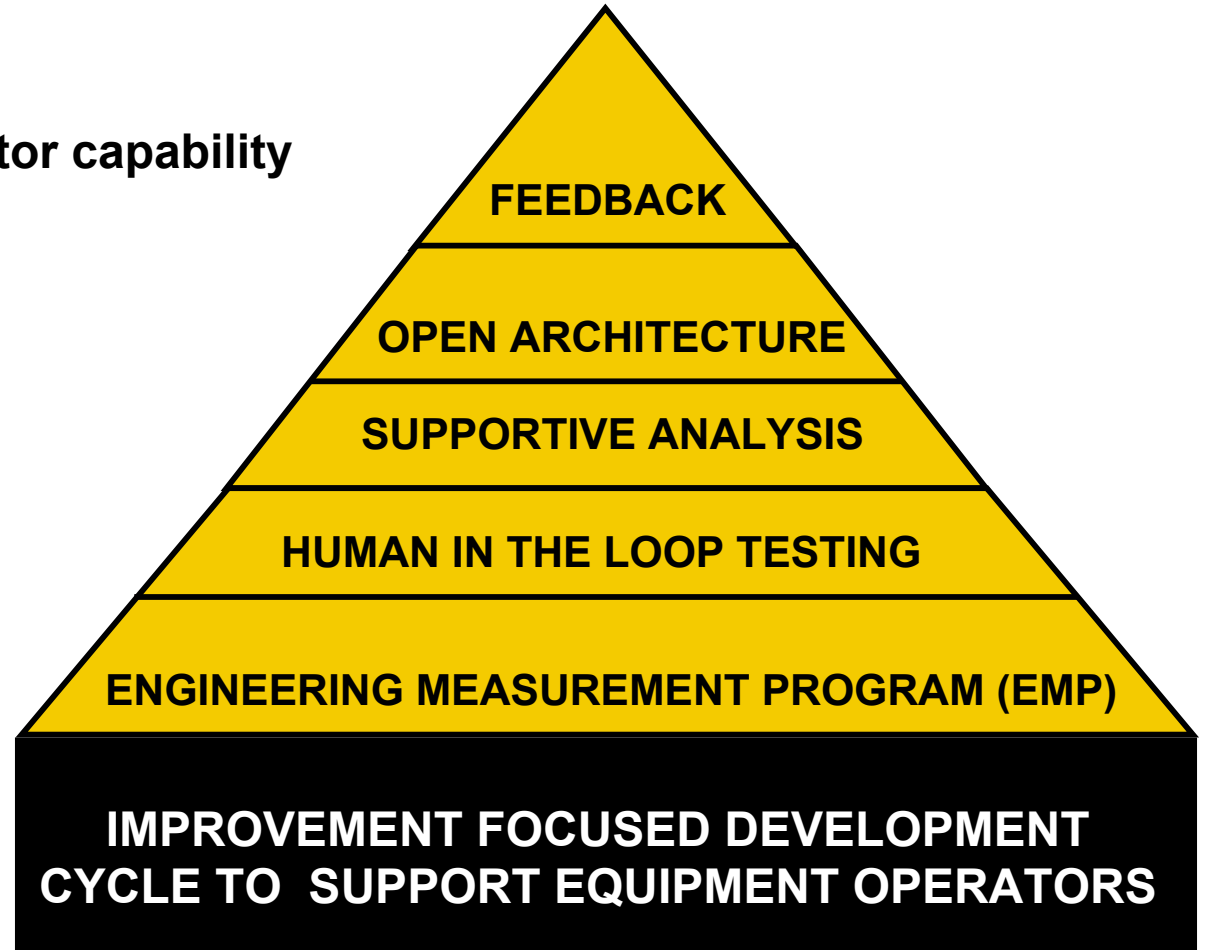
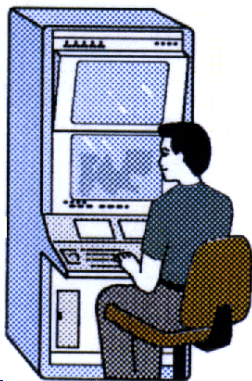
HSI in Undersea Warfare

•EMP Highlights:

IMPROVED OPERATOR PERFORMANCE

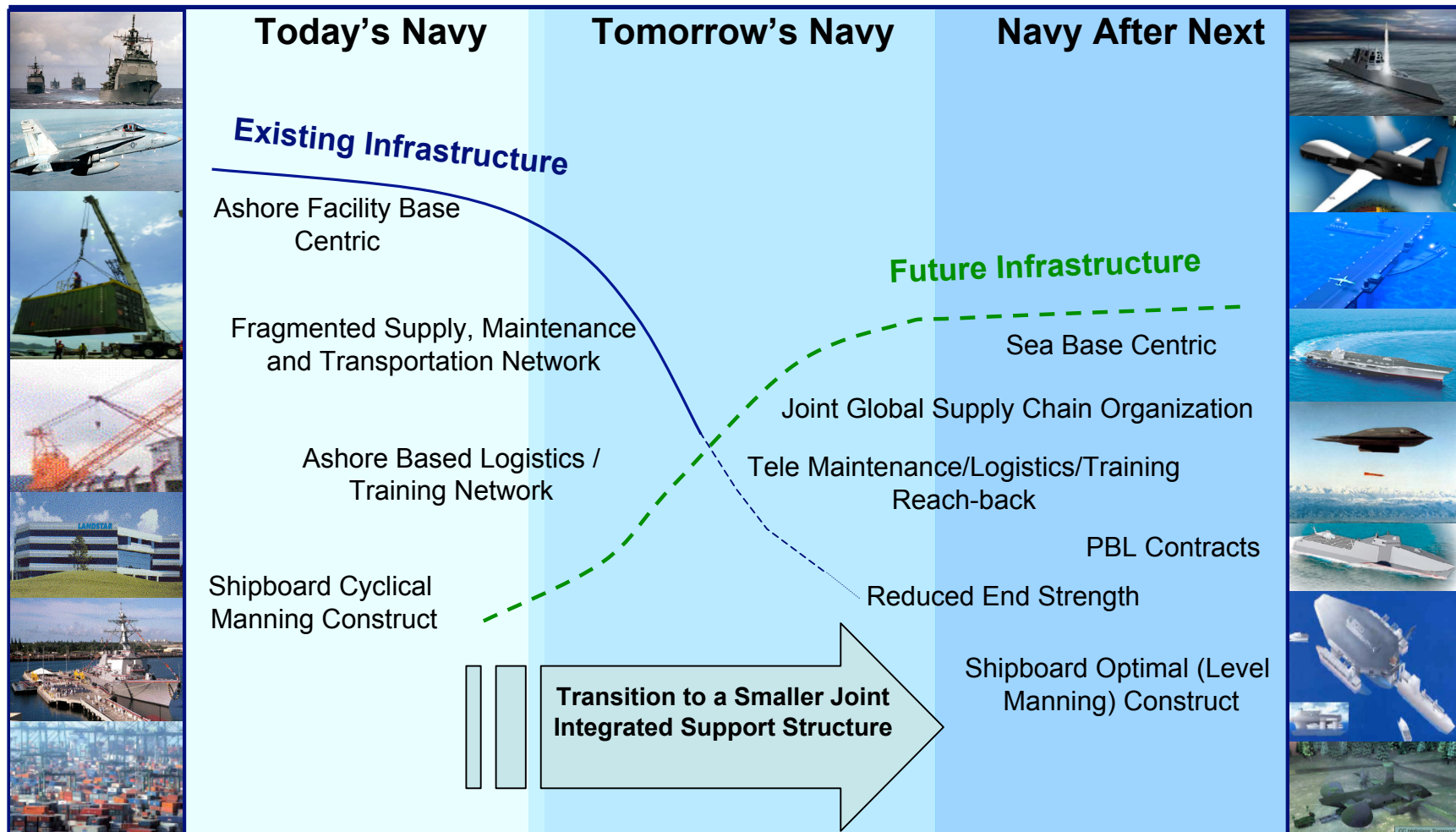
•Specific areas of focus:

- Varying level of operator capability
- Data editing
- Inefficient layout
- Hidden data
- Display methods



SIMULTANEOUS SYSTEM AND OPERATOR TRAINING EQUALS IMPROVED INTEGRATION

CNO's Challenge



**Navy Cannot Afford the Existing Infrastructure
.....or Multiple Infrastructures**

Distance Support Enabling the Enterprise

Warfighting Support

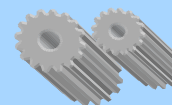
Manpower,
Personnel, Training
& Education



Total Enterprise Approach

Logistics

Maintenance



Distance Support . . . "will allow us to operate at sea with fewer ships, improved business efficiency, shape tomorrow's infrastructure and help deliver SEA Warriors."

CFFC Msg 021912Z NOV 04

Distance Support Assumptions

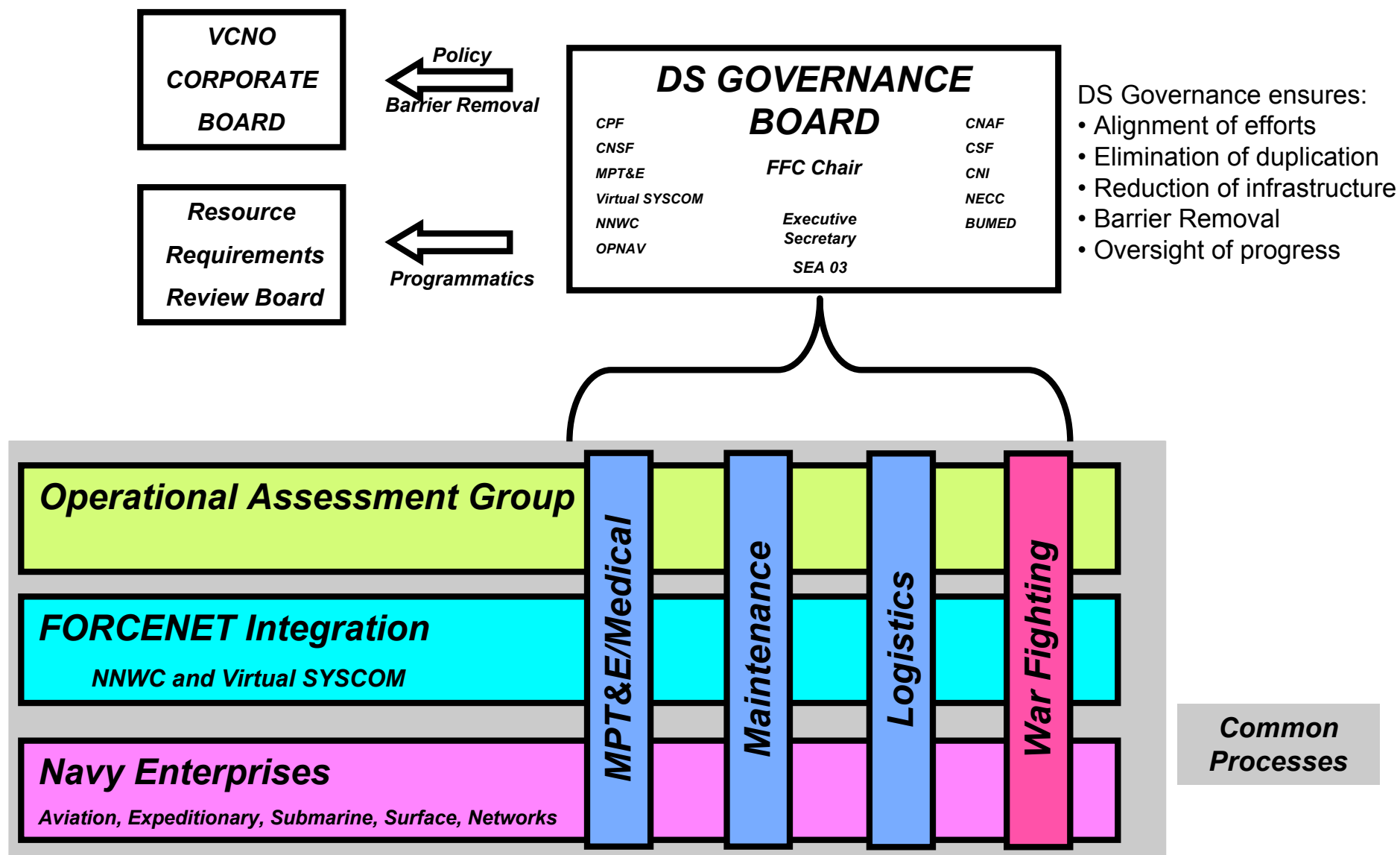
- **Concept**
 - **DS will change the means by which operational forces are supported**
 - **DS will change organizational relationships, business processes, and workforce skills**
- **Process**
 - **DS will reduce and improve the efficiency of existing infrastructure**
 - **DS is a pre-requisite for optimal manning**
- **Product**
 - **DS needs acquisition and program management focus**
 - **DS 2.0 will be fully funded across the FYDP**
- **All**
 - **Enterprise and Functional Area Leads will cooperate to merge DS related efforts**
 - **Fleet Governance will adjudicate deltas between Enterprises as required**

Distance Support Challenges

- **Common definition**
- **Strategic focus/plan**
- **“Stovepipe” culture**
- **Communications/Data sharing**
- **Bandwidth**
- **Commonality:**
 - **Processes**
 - **Applications**
 - **Data/Content**
 - **Configuration Management**

Bigger than any single Enterprise or SYSCOM

DS Governance





Human Systems Performance Assessment Capability (HSPAC)



OBJECTIVES

- **Human Performance Analysis**
 - Requirements Definition
 - Human Performance in AoA
- **HSI Common Infrastructure**
 - Common, Shared HSI Toolset
 - Common Simulation Environment
 - Human Performance Data Repository
 - Sea Warrior Integration
 - Available to Industry
- **Total System Support**
 - Total System Interoperability
 - Impact of KSAs, Workload, and Human Error
 - Specific Metrics Incorporated Into DT/OT Assessments
- **Human Performance Testing**
 - Usability Engineering
 - FORCEnet
 - Major Programs Work Initiated
 - Measure, Test, & Certify

Progress to Date and Course to Implementation

Warfighter Performance

Requirements & Capabilities

Leadership Acquisition

DD(X) Sailor
System Specification

LCS Cross-
Functional Teams

HSP- AC/ HSI Port

SHIPMAIN / C5IMP

vSYSCOM Program
Managers Guide

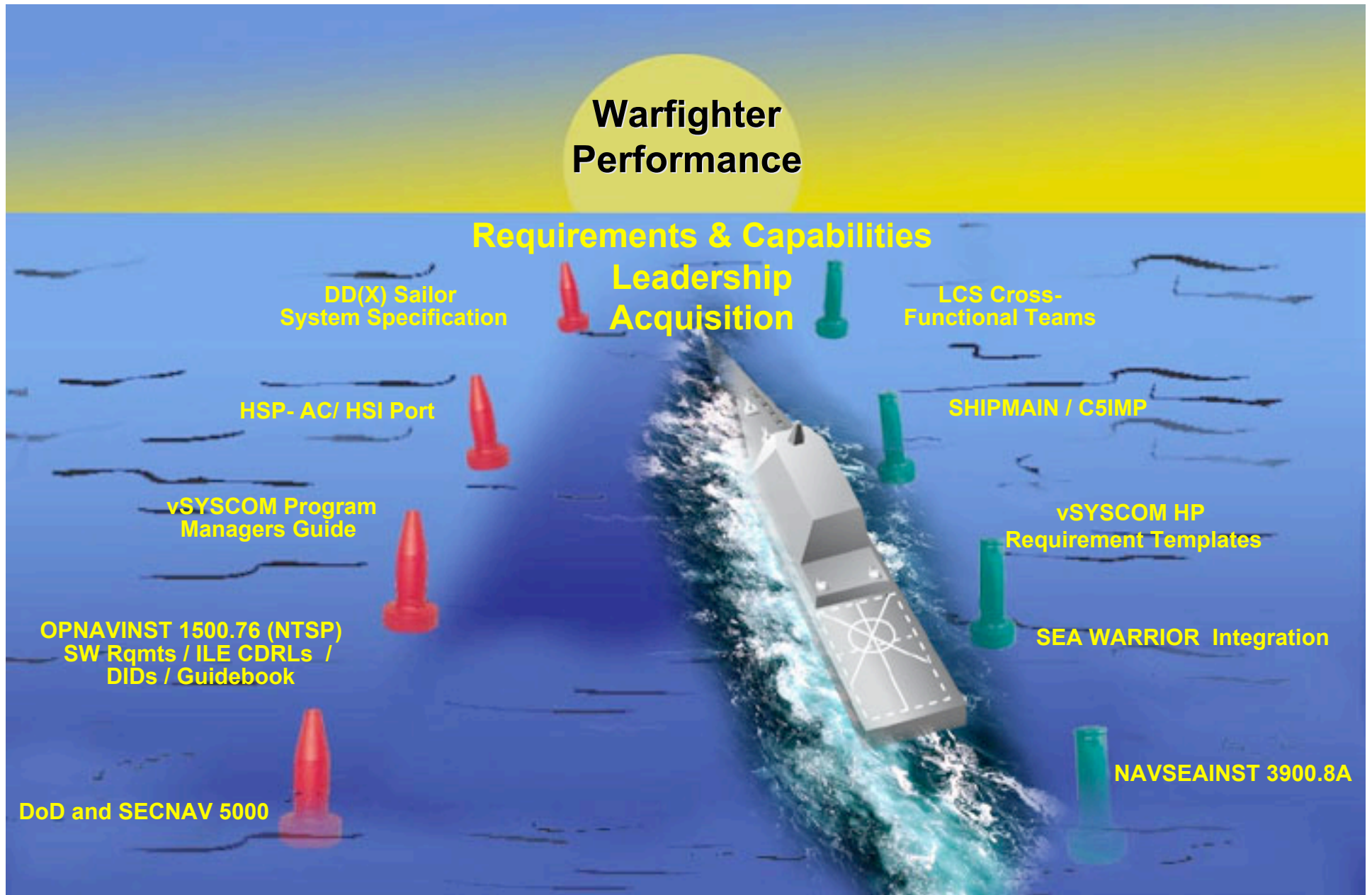
vSYSCOM HP
Requirement Templates

OPNAVINST 1500.76 (NTSP)
SW Rqmts / ILE CDRLs /
DIDs / Guidebook

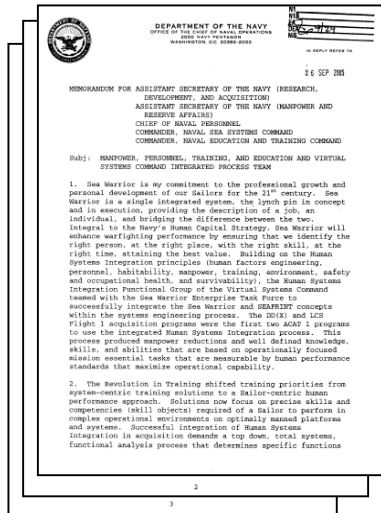
SEA WARRIOR Integration

DoD and SECNAV 5000

NAVSEAINST 3900.8A



Effects of Human Systems Integration



OPNAV
PEOs
Tech/Certifying
Authority

CNO GUIDANCE / TASKING

- SEA Warrior
- Human Systems Integration
- Human Performance
- SEA Print

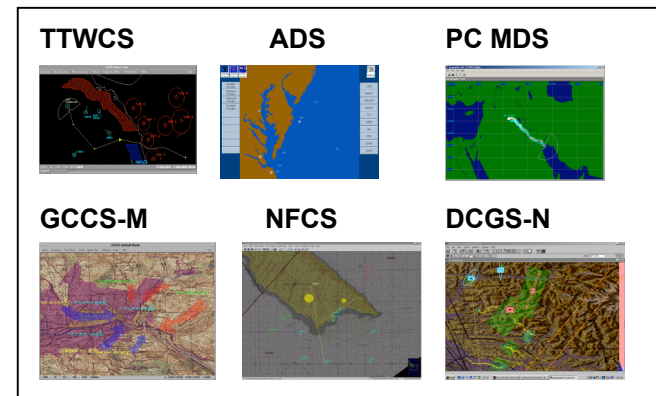
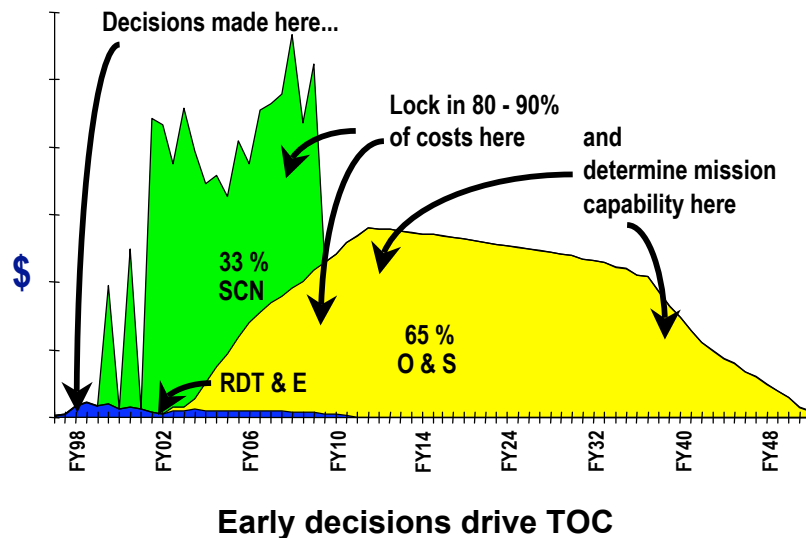


OUTPUT

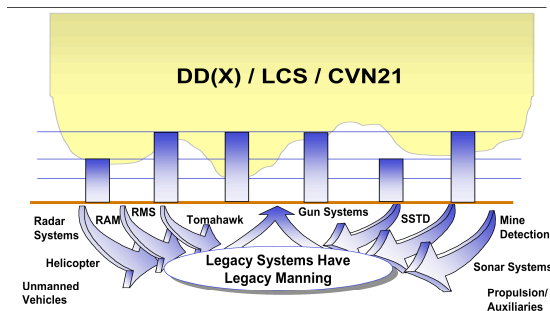
- Optimal mission readiness through skills analysis, tailored training and certified warfighter performance
- Integrated sea/shore based infrastructure
- Best Total Ownership Cost

Backup

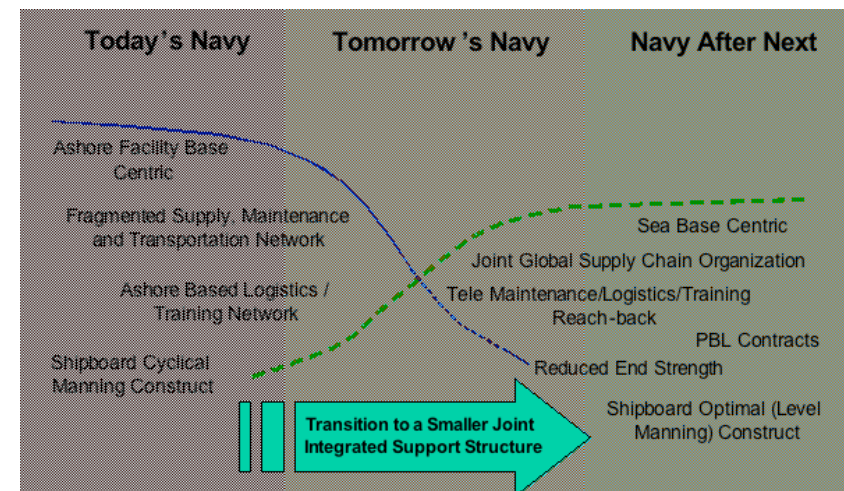
Why Human Systems Integration?



Warfighting impact of ignoring human performance
– human failure as key risk element



Legacy systems, culture & infrastructure are hidden drivers of manpower requirements



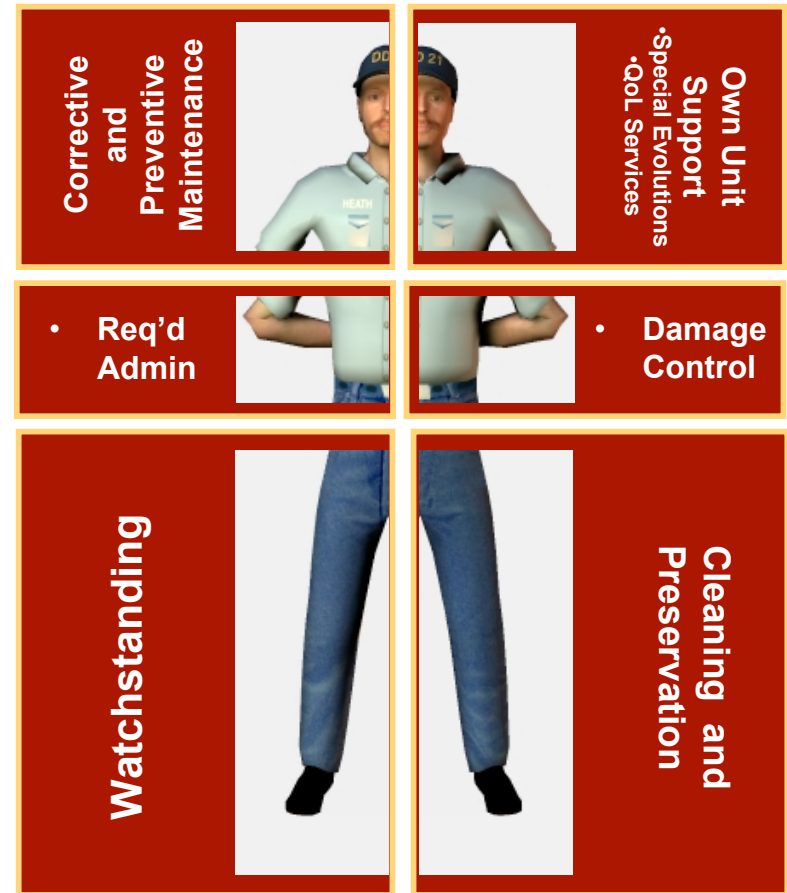
Sailor System Specification

- **Description**

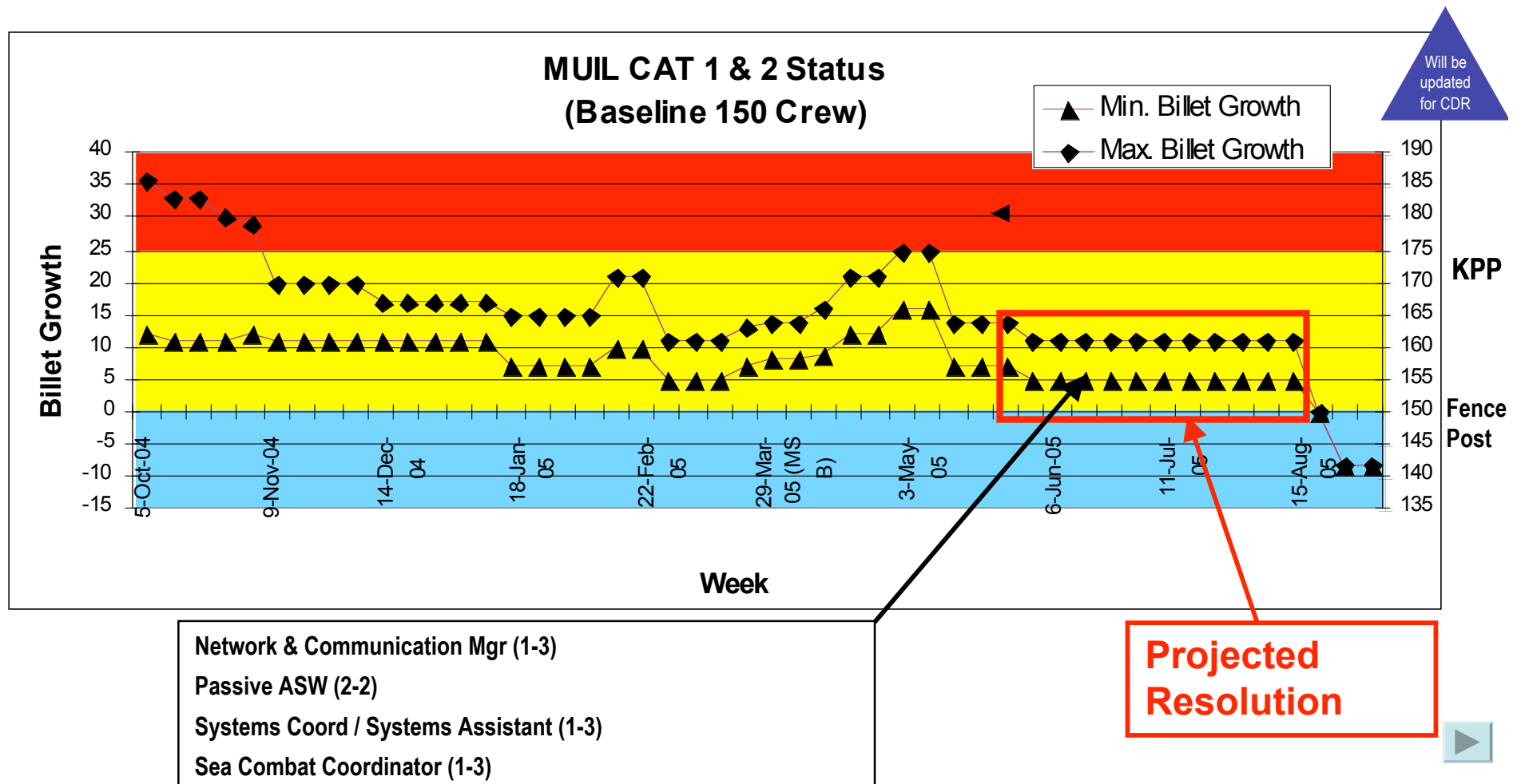
- Sailor System Spec (S3)
 - System level subset of the SPD
 - Decomposes requirements to lower levels
 - Appropriate level to INFLUENCE DESIGN
- S3 incorporates multi-level requirements
 - Standards / Guidelines
 - Decision Support / Automation
 - GUI Style Guide
 - Onboard / Shore Support
 - Performance Requirements
 - Other Requirements

- **Key Process Attributes**

- Resident in DOORS database
- Updated per SPD Cycle
- Flow down to Segments and EDMs
- Developed by discovery, standards, collection of activities, venues to validate HCI prototype
- Integrates a crosscutting skill mix among operators and maintainers and evolving levels of automation

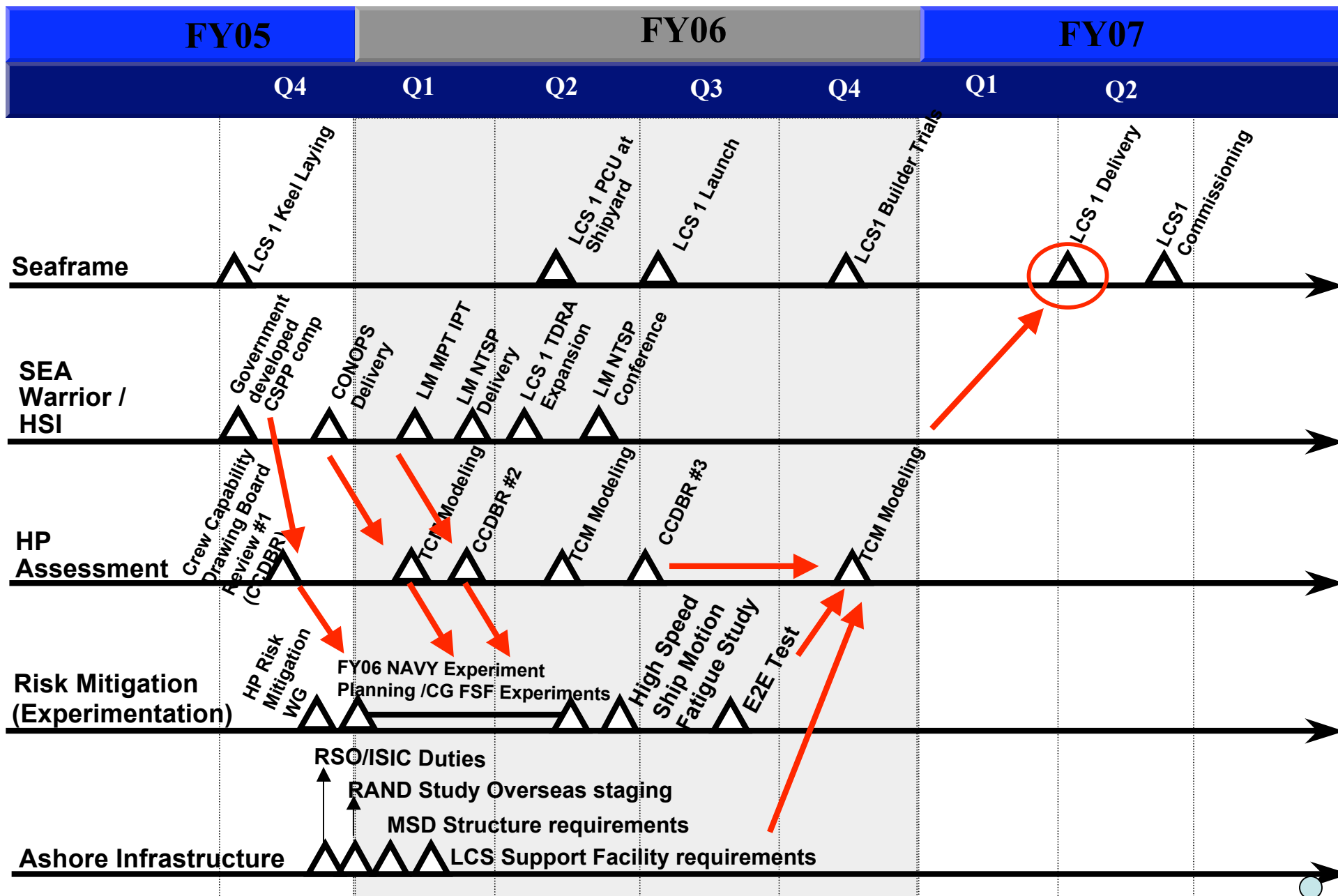


Manning Uncertainty Issues List Resolution

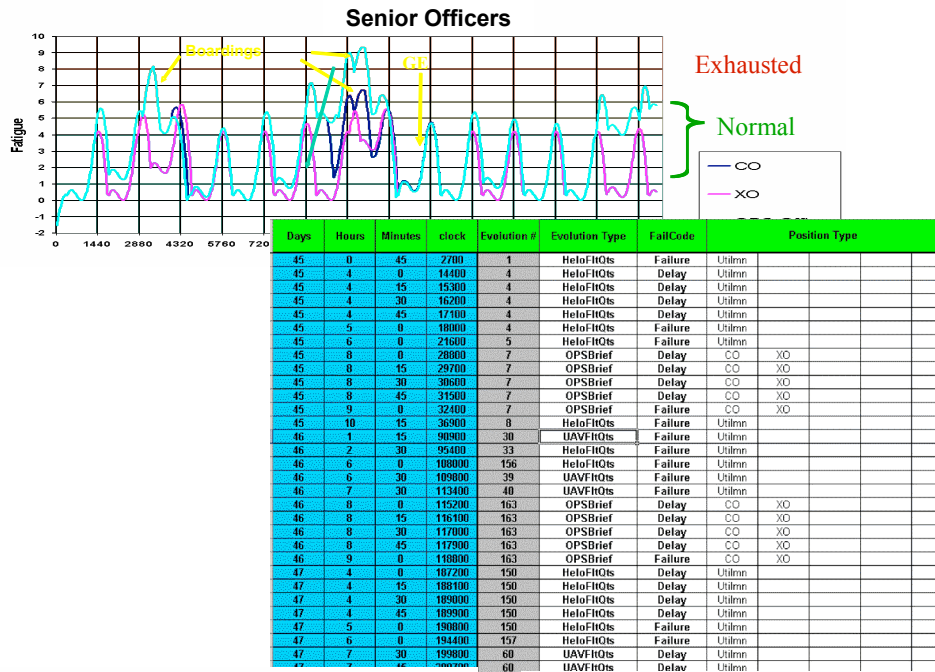


Technical Director and Program Management Involvement through MUIL Process Provides Confidence in Meeting Manning Fencepost and KPP

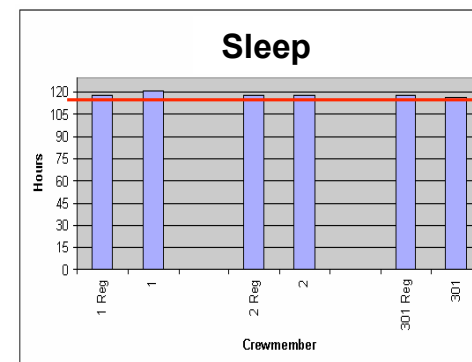
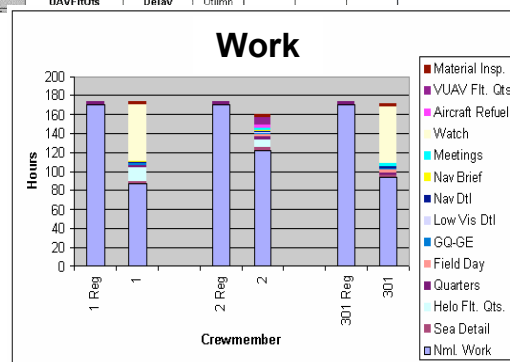
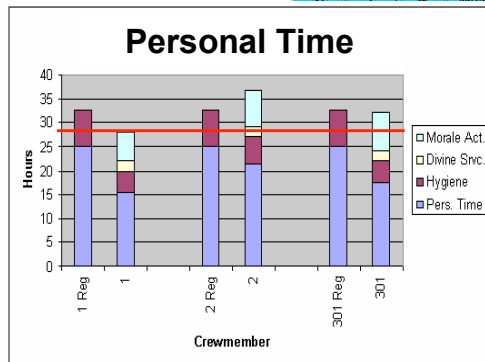
Integrated LCS / SEA Warrior POA&M for LCS 1



Total Crew Model Outputs



- Model Results:
 - Crew Fatigue
 - Hours Available for Off-Watch Work
 - Hours of Sleep
 - Successful/Failed Evolutions



Engineering Measurement Program (EMP)

An Overview

EMP Objectives:

- Produce quantitative data to support model reconciliation, assessment analyses & a system design process fully coupled with **real-world operational** & test/experiment experience
- Continue assessment of fielded systems beyond acquisition test and evaluation
- Establish an objective methodology that provides early feedback to a system improvement process focused on performance in operational scenarios

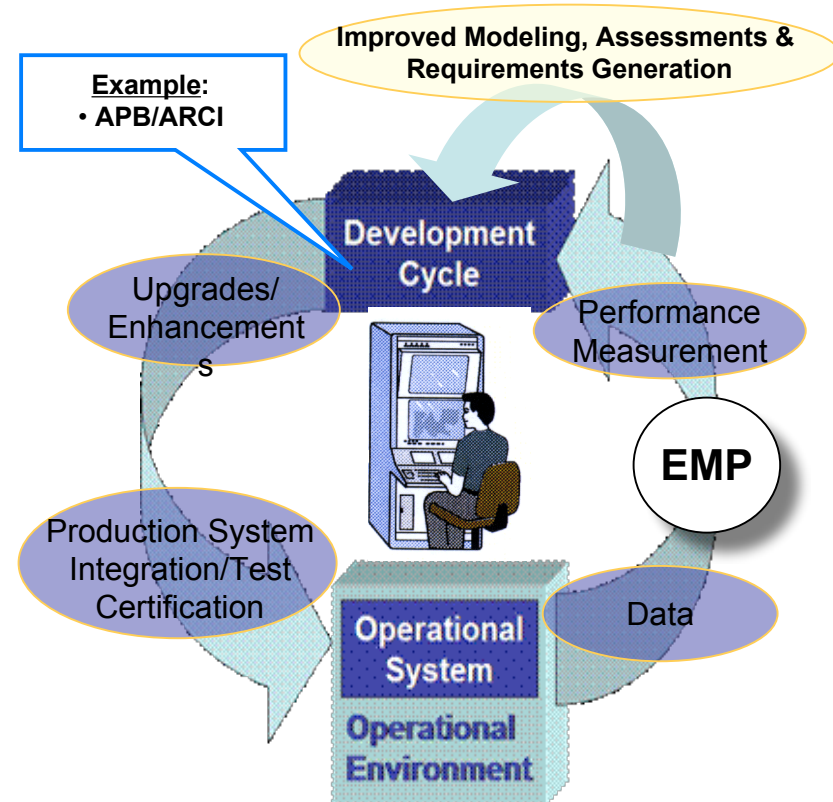
EMP Essential Elements:

- Improvement-focused development cycle
- System builds with open architecture with flexibility to insert tap-points
- Embedded recorders to extract data from system's tap-points
- **Actual fielded system** used in laboratory analysis; expert analysts/engineers
- Fleet liaison for case selection & analysis reconciliation

Acoustic Rapid COTS Insertion (ARCI) EMP (AEMP) Level 4 Performance Assessments:

- Provide quantitative feedback of ARCI/APB software builds by playing back real world data sets to Fleet sonar operators of varied experience levels in-laboratory
- To date we have completed successful testing using towed array data sets on Advanced Processing Build APB-00, APB-02, and APB-03 systems

Engineering Measurement Programs:



- Overall AEMP Level 4 Performance Assessments have demonstrated towed array system improvements with each successive system tested
- Recommendations are fed back to the Fleet and the development communities to incorporate changes in successive system builds